

Interactive comment on “Full-fit reconstruction of the Labrador Sea and Baffin Bay” by M. Hosseinpour et al.

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General comments

The discussion paper presents an interesting review of the controversially discussed opening of the Labrador Sea and Baffin Bay region, embedded in a full-fit reconstruction for the area. The conclusions generally confirm the most recent seismic observations. Given the simplifications that have to be made for such a large region with still relatively sparse seismic data coverage, the results present a good framework for future studies.

Below, numbers in brackets refer to page and line number, e.g. (919/20) line 20 on page 919.

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Specific comments

The figures, even when enlarged on the screen, are difficult to read. They contain a lot of information that is written in too small a font size. This destroys very much the flow of reading. Figures A1, B1, and C1 are so small that I was unable to review them.

(919/19) The time scale of Gradstein et al. 2004 is used. I would suggest using the most recent update (Gradstein et al. 2012).

(921/14-17) Rifting and extension most likely started before 160 or 140 Ma. Larsen et al. 2009 (J. Geol. Soc, 166: 999-1012) suggest initial stretching in the Late Triassic to Late Jurassic (223-150 Ma) based on the production of highly alkaline, volatile rich melts formed in small volumes in the deep lithosphere.

(926/20-24) A thickness grid for the high-velocity bodies has to be shown in a figure. Otherwise it is impossible to decide if this step in the calculation was done correctly. High-velocity lower crustal bodies are probably widespread in the Davis Strait region based on the distribution of Paleogene volcanics. Hence, it would be important to see how the volcanic distribution map (e.g. Skaarup et al. 2006) matches with the high-velocity lower body grid.

(Section 4.2) It is unclear how t_c was obtained in the compilation of the gamma factor in Fig. 9.

(Fig. 9) The area of undisputed oceanic crust should be masked on the gamma grid, as oceanic crust was not thinned.

(928/6-7) No reason is given for the choice of the reference crustal thickness. Why are different values used for Greenland and North America? At the time of rifting, the crustal thickness at the later COB should have been identical.

(Section 4.3) No description is given how the location of the “UCCL” was chosen.

(930/1) The start of rifting is given here at 120 Ma, which contradicts the values pre-

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sented in the tectonic setting (160 or 140 Ma).

(929/9-21) Inaccurate terminology is used in the description of the geology. First of all, all geological names mentioned in the text have to be labeled in Fig. 11. Second, there are some typos (correct spelling is Makkovik and Nordre Isortoq). Third, an "orogeny" is not a "line" that "separates" one region from another but is a geological process that results in the formation of an orogen. The region north of "line 1" in Fig. 9 is the "Committee-Melville Orogen". "Line 1" would be the southern border of the CMO. Similar with the "Makkovik and Ketilidian orogeny": the border ("line 4") is not the Makkovik and Ketilidian orogeny! South of "line 4" lies the Makkovik Province on the Canadian side and the Ketilidian fold belt on the Greenland side. The "line" (=structure) that separates the Makkovik Province and the Ketilidian fold belt from the North Atlantic craton would probably be the Kanairiktok shear zone on the Canadian side.

(931/24 - 932/5) I think you have to be slightly more cautious when saying that your models do not require internal deformation of Greenland and North America. First, I do not think that the resolution in the data is sufficient to exclude any such deformation. Second, some deformation should have occurred during the Eureka orogeny (a major period of late Cretaceous-Paleogene tectonism in northern Canada and Greenland).

No thoughts are given on the presence of exhumed mantle in the COT. In the preferred model (7), the COB lies seaward of the region where exhumed mantle is expected/interpreted. The gravity derived crustal thickness model for the COT would significantly overestimate the thickness of true continental crust as all serpentinized mantle would essentially be counted as crust. As consequence, the RCOB would be farther seaward. A quantitative estimate should be given, how large the error could be.

As a general information, additional refraction seismic lines are published for the area. There are a number of lines onshore and offshore Labrador (references can be found in the summary of Hall et al. 2002, *Can. J. Earth Sci.*, 39: 569-587; + Funck et al. 2008 (*Can. J. Earth Sci.* 45: 465-481)) and in the southern Nares Strait (Funck et al.

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2006, *Polarforschung* 74: 97-112).

(Fig. 8) shows that the gravity grid systematically underestimates the crustal thickness for values >34 km when compared with the refraction seismic. If the parameters for the reference crustal thickness or the location of the UCCL are based on the gravity-derived thickness grid, the results for the RCOB could potentially be biased.

(Fig. 7) no reference is given to the seismic lines shown. There is also no reference for the receiver functions. All receiver functions onshore Greenland are published by Dahl-Jensen et al. (2003, *Earth Planet. Sci. Lett.* 205: 379-393). By the way, these receiver functions show crustal thicknesses exceeding the results from the gravity inversion that are stated in the figure caption. Station SFJ has 47 km, station PAA 42 km, both are close to the coast. Even with some error, this is much more than the reference crustal thickness of 36 km that was used for the calculation of the RCOB in Greenland.

Technical corrections

Different times for the cessation of seafloor spreading are mentioned: (920/15) states 34 Ma, while 49 Ma are mentioned in (920/25).

Different times are mentioned for the age of chron 13: 35 Ma (921/3) , 34 Ma (920/15).

(921/19) The cited paper by Sandwell and Smith (2009) does not say anything on sediments and volcanics in the study area and should therefore be deleted.

I noticed several references that are missing in the reference list (e.g. Reston 2009, Okulitch et al. 1990)

(922/25) the UFZ is referred to in Fig. 3 but is not shown there.

(926/17 and other occurrences) If spaces are to be added in the line numbers, this should not be done as 20 080 600 but as 2008 0600 as the first four digits correspond to the acquisition year. The full line name is actually AWI-20080600. This applies to other line names as well: (e.g. AWI-20080500, AWI-20080700, AWI-20100400)

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(928/4) The abbreviation "UCCL" is never explained in the entire paper.

(928/7) Should be Fig. 10 and not 11.

(929/8) Should be Fig. 11 and not 12.

(931/1-2) There should be no paragraphs with just one sentence.

(931/18) Please specify what exactly you mean by "channels" in this context.

(931/18) delete "the" before Greenland

(933/27) wrong spelling of "Døssing"

(937/18) a word/noun is missing after the adjective "continental"

(941/6-7) The reference given for Kusznir (2009) is not sufficient. Is it a book, journal article, report, conference contribution? Who is the publisher?

(Table 2) Parameters a through f are not explained.

All figures with maps should have a scale bar.

(Figure caption 1) "NUGGET" not "NAGGET"

(Figure 1) a number of lines run under #16, which are referred to as Harrison et al. (2011). Many of these lines were already published earlier and proper reference should be given. I could for example identify the lines of Keen and Barrett (1972).

(Figure 1) line #14 is a composite line consisting of AWI-20080500 and AWI-20100400.

(Figure 1) line #12 is listed with the wrong name (should be AWI-20080700) and with a wrong reference (should be Suckro et al. 2013, which is also missing in the reference list)

(Figure 5) Profile name for the model at the bottom of the left column is wrong (is the composite line consisting of AWI-20080500 and AWI-20100400).

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(Figure 6) some author names are misspelled, should be Louden and Müller

(Figure 11) The ice shield in southernmost Greenland is shown in grey but should be in white.

(Figure 14) The purple (?) lines are not explained (I assume UCCL and COB or RCOB?). The legend says that stretched continental crust is plotted in light blue. Why is then all continental crust shown in this color?

Interactive comment on Solid Earth Discuss., 5, 917, 2013.

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